

In re application: Jun Zheng  
Filed: August 16, 2001  
Response Dated 05/12/2003

PAGE 6 OF 9

Serial No.: 09/931,669  
Attorney's Docket: PAT036US  
Reply to Office action of 02/12/2003

### REMARKS/ARGUMENTS

Claims 1, 3-4, 6, 10, 13-15, 17, and 20 remain in this application. Claims 1, 3-4, 6-7, 9-11, 13-15, 17, 20-21 and 23 have been rejected. Claims 1, 6, 10, 17, and 20 have been amended and claims 7, 9, 11, 21 and 23 have been canceled, to more particularly point out and distinctly claim the subject matter of the present invention. Applicant hereby requests further examination and reconsideration of the application in view of the foregoing amendments and these remarks.

#### **Rejections Under 35 U.S.C. § 112(2)**

On page 2 of the Office Action, the Examiner rejected various claims under 35 U.S.C. § 112(2) as being indefinite. Claims 7, 9-11, 13-15, and 17 depend from canceled claims 5 and 16. The variously amended claims no longer have the improper dependency.

The Examiner stated that, re claims 1, 22, and 23 it is unclear/vague what "material outside the active region" is being claimed and how it relates to the claimed device. And that "adapted to be optically pumped" and "during optical pumping thereof" are indefinite; this provides no structure or structural cooperative relationships to establish what is being claimed. The Examiner stated that if Applicant wishes to claim function without reciting structure then a means for clause should be used.

The Examiner also stated that the claims recite a bottom mirror but no top mirror to establish the resonator cavity.

Claims 22 and 23 are canceled, rendering the objection thereto moot. Claim 1 has been amended. Various dependent claims have been amended or canceled accordingly. As for claim 1, Applicant notes that "material outside the active region" is not a term used in claim 1, either as it previously stood or as currently amended. Claim 1, as amended, recites, in part:

- an active region layer means for generating light in response to optical pumping, the active region layer means comprising active region material and having a bottom and a top surface;
- an optical pumping means for pumping light into an active region section of the active region layer means to cause the active region section to generate light therein and to emit said light out of its top surface, wherein the active region section is adjacent portions of the active region layer means outside the active region section, wherein the active region layer means is disposed at its bottom surface on the bottom mirror;
- a heat-spreading layer disposed directly on the top surface of the active region on the active region section and the portions of the active region layer outside the active region, the heat-spreading layer comprised of a material having a thermal conductivity greater than that of the active region layer means whereby some of the heat generated in the active region section during optical pumping thereof by said optical pumping means is conducted from the top

In re application: Jun Zheng  
Filed: August 16, 2001  
Response Dated 05/12/2003

PAGE 7 OF 9

Serial No.: 09/931,669  
Attorney's Docket: PAT036US  
Reply to Office action of 02/12/2003

surface of the active region section into the portions of the active region layer outside the active region via the heat-spreading layer;  
a top mirror disposed above the heat-spreading layer such that the active region section is interposed between the top mirror and the bottom mirror.

Applicant submits that this claim language is clear, supported by the Specification, and overcomes the § 112(2) indefiniteness rejections.

#### Rejections Under 35 U.S.C. § 102(b)

On pages 3-4 of the Office Action, the Examiner rejected claims 1, 3-4, 6, 20-21, and 23 under 35 U.S.C. § 102(b) as being anticipated by Uchida (US 6057560). The Examiner stated, inter alia, that Uchida teaches a heat-spreading layer (105) disposed directly on top of the active region and on active region layer portions outside the active region, whereby some of the heat (inherent feature of InP as disclosed by the Specification) generated in the active region during optical pumping is conducted from the top surface of the active region into the active region layer portions outside the active region via the heat-spreading layer.

Applicant submits that claim 1, as amended, is neither anticipated nor rendered obvious by the cited references. Applicant's claimed invention has an active region layer. A section of this layer is pumped with an optical pumping means; this pumped section generates laser light. Sections or portions of the active region layer outside the active region section do not generate light. The heat-spreading layer is on the top surface of the entire active region layer, and therefore conducts heat from the top of the active region layer over the active region section (the section being optically pumped), through the heat-spreading layer, and down into the portions of the active region layer that are adjacent to the active region section. Thus, additional heat is carried away from the active region section via its top side. Specification, page 1, first paragraph, et pass.; Fig. 2.

These claimed features are not taught or suggested by Uchida. Uchida employs a mesa structure, so that the entire active region is isolated from others. There is no way for any heat to be conducted from the top of the active region of Uchida into the InP layer above it, since it does not extend laterally and contact the top surface of active-region layer outside the active region. Moreover, Uchida teaches an electrically-pumped VCSEL not an optically-pumped one, as claimed

In re application: Jun Zheng  
Filed: August 16, 2001  
Response Dated 05/12/2003

PAGE 8 OF 9

Serial No.: 09/931,669  
Attorney's Docket: PAT036US  
Reply to Office action of 02/12/2003

by Applicant. In Applicant's invention, the top DBR cannot be directly on top of the active region, since the OP laser has to pump into the active region through its top surface. The top DBR in Applicant's claimed invention is above the heat spreading layer, which is disposed on the active region layer. Contrasted to a conventional OP VCSEL, as illustrated in Fig. 1 of the Application, which has no way to remove heat from the top of the active region, Applicant's claimed invention can remove heat also from the top of the active region, because the heat-spreading layer conducts the heat from the top of the active region, and down into adjacent active-region layer material outside the active region itself. These feature are not taught or suggested by the cited references.

The Examiner stated that Uchida's heat-spreading layer (105) is disposed on top of the active region and on active region layer portions outside the active region, so that some of the heat generated in the active region during optical pumping is conducted from the top surface of the active region into the active region layer portions outside the active region via the heat-spreading layer. However, Uchida is electrically pumped, not optically pumped, as assumed by the Examiner. Additionally, Uchida has a mesa structure (common in electrically pumped VCSELs which require electrical isolation from others in an array) in which the active region section 104 (electrically pumped by current from electrodes 110, 109) terminates at protective layer 108 (Uchida, Fig. 2; col. 7, line 29, 37-38). There is *no* active region layer portion outside the active region section 104. Even if heat is carried up from active region 104 into layer 105, layer 105 does not extend laterally beyond active region section 104 into portions of an active region layer outside section 104, so that it could conduct heat back down. Instead, layer 105, like active region section 104, terminates at the mesa walls bounded by *protective layer 108*. Applicant respectfully submits that Uchida clearly does not teach or even suggest the features of Applicant's claimed invention, nor does it permit the advantages obtainable from Applicant's claimed invention.

In view of the foregoing remarks and amendments, independent claim 1 and its variously dependent claims, as variously amended, are believed to be in condition for allowance. Applicant respectfully requests that a timely Notice of Allowance be issued in this case.

The Assistant Commissioner for Patents is hereby authorized to charge any additional fees or credit any excess payment which may be associated with this communication to our deposit account 50-1705.

In re application: Jun Zheng  
Filed: August 16, 2001  
Response Dated 05/12/2003

PAGE 9 OF 9


Serial No.: 09/931,669  
Attorney's Docket: PAT036US  
Reply to Office action of 02/12/2003

The Assistant Commissioner for Patents is hereby authorized to charge any additional fees or credit any excess payment which may be associated with this communication to our deposit account 50-1705.

The undersigned may be contacted for any questions.

Respectfully submitted,

Date: December 30, 2003

  
\_\_\_\_\_  
N. Stephan Kinsella, Esq.  
Registration No. 37,657  
APPLIED OPTOELECTRONICS, INC.  
13111 Jess Pirtle Boulevard  
Sugar Land, Texas 77478  
Telephone: 281-295-1800  
Telephone: 281-295-1808 (direct)  
Facsimile: 281-295-1889